NEWS SCIENCE NEWS

FROM WATER MEMORY TO DIGITAL BIOLOGY

by Dr Jacques Benveniste
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Our principal mission is to bring a clear and irrefutable answer to the controversy over our observations of what has come to be known as "the memory of water" phenomenon, that is:

• that water is capable of carrying molecular information (biological messages); and

• that it is possible to transmit and amplify this information, as can be done for sounds and music.

We consider the indicators and the stakes to be such that it would be irresponsible not to bring forth the earliest possible explanation.

History of Digital Biology Research

Dr Jacques Benveniste is at the origin of this work. Doctor of Medicine, former Resident of the Paris hospital system, Research Director at the French National Institute for Medical Research, and known worldwide as a specialist in the mechanisms of allergy and inflammation, he distinguished himself in 1971 by his discovery of PAF (platelet activating factor), a mediator implicated in the mechanisms involved in these pathologies (for example, asthma).

In 1984, while working on hypersensitive (allergic) systems, by chance he brought to light the so-called high-dilution phenomenon, which was picked up by the media and labelled "the memory of water".

The phenomenon referred to involves diluting a substance in water to a degree where the final solution contains only water molecules. With the hypersensitive systems he was using, however, he observed that this highly diluted solution initiated a reaction as if the initial molecules were still present in the water. Water kept a trace of the molecules present at the beginning of the dilutions.

International scientific reaction was undoubtedly a match for the implications of this discovery: incredulity, even rumours of fraud, though an investigation made by experts came to the conclusion that it might be an artifact, but it was under no circumstances fraudulent.

From a scientific standpoint, we dismiss all of this, for the history of science has already shown us that the more a discovery runs counter to intuition and "good" common sense, the more its acceptance is long and difficult.

From the first high-dilution experiments in 1984 to the present, thousands of experiments have been done, enriching and considerably consolidating our initial knowledge. Up to now, we must observe that not a single flaw has been discovered in these experiments and that no valid counter-experiments have ever been proposed.

In biology, the words "molecular signal" are used very often; yet, if you ask even the most eminent biologists what the physical nature of this signal is, they seem not even to understand the question and stare at you wide-eyed.

Furthermore, these experimental observations, far from opposing currently accepted biological theories, can be integrated as an extension to them.

Finally, the probability that we are in the presence of an artifact and that our work has been erroneous for the past 15 years is diminishing day by day, and we are more and more convinced that we have brought to light a phenomenon essential to biology and to life.

On this basis, DigiBio's object is to become the essential actor in the scientific and industrial developments which will emerge from this research.

Understanding Digital Biology

Explaining digital biology is impossible without explaining its principle. The purpose of this text is not to report experimental results; rather, to try to explain to laymen, in the simplest terms, this radically new approach to biology. We hope it will be useful to all, scientists or not, who find it hard to "make the leap". Indeed, is it possible to believe that the specific activity of biologically active molecules (e.g., histamine, caffeine, nicotine, adrenalin), not to mention the immunological signature of a virus or bacterium, can be recorded and digitised using a computer sound card, just like an ordinary sound? Imagine the perplexity of Archimedes confronted with a telephone and being told that by using it he could be heard on the other side of the world, were we not to explain the nature of sound waves or their translation into electromagnetism.

Life depends on signals exchanged among molecules. For example, when you get angry, adrenalin "tells" its receptor, and it alone (as a faithful molecule, it talks to no other), to make your heart beat faster, to contract superficial blood vessels, etc.

In biology, the words "molecular signal" are used very often; yet, if you ask even the most eminent biologists what the physical nature of this signal is, they seem not even to understand the question and stare at you wide-eyed. In fact, they've cooked up a rigorously Cartesian physics all their own—as far removed as possible from the realities of contemporary physics—according to which simple contact (Descartes' laws of impact, quickly disproved by Huygens) between two coalescent structures creates energy, thus constituting an exchange of information. For many years, I believed and recited this catechism without realising its absurdity, just as mankind did not realise the absurdity of the belief that the Sun circles the Earth.

The truth, based on facts, is very simple. It does not require any "collapse of the physical or chemical worlds". That molecules vibrate, we have known for decades. Every atom of every molecule and every intermolecular bond—the bridge that links the atoms—emits a group of specific frequencies. Specific frequencies of simple or complex molecules are detected at distances of billions of light-years, thanks to radio-telescopes.

Biophysicists describe these frequencies

as an essential physical characteristic of matter, but biologists do not consider that electromagnetic waves can play a role in molecular functions themselves. We cannot find the words *frequency* or *signal* (in the physical sense of the term) in any treatise on molecular interactions in biology, not to speak of the term *electromagnetic*—use of which, at least in France, would be cause for excommunication of any offending biologist by the scientific papal office.

Like Archimedes, I would have liked to have had a brilliant idea in my bathtub: "Eureka, the vibrations of molecules don't exist for them to dance the salsa at a Saturday night ball; vibrations are the tools of their trade, which allow them to send instructions to the next molecule down the line in the cascade of events which govern biological functions and probably, to a large extent, chemical ones as well." Unfortunately, this was not the case. I followed a purely experimental approach.

Molecular Signalling

Around 1991, after eight years of research, my experiments showed that we could transfer specific molecular signals by using an amplifier and electromagnetic coils. In July 1995, I recorded and replayed these signals using a multimedia computer. A computer sound card only records frequencies up to about 20,000 Hz.

In the course of several thousand experiments, we have led receptors (specific to simple or complex molecules) to "believe" that they are in the presence of their favourite molecules by playing the recorded frequencies of those molecules.

In order to arrive at this result, two operations are necessary: (a) to record the activity of the substance on a computer; and (b) to "replay" it to a biological system sensitive to the same substance. Therefore, there is every reason to think that when a molecule itself is in the presence of its receptor, it does the same thing: it emits frequencies which the receptor is capable of recognising. This means that:

1. A molecular signal can be efficiently represented by a spectrum of frequencies between 20Hz and 20,000 Hz—the same range as the human voice or music.

For several hundred thousand years, human beings have been relating sound frequencies to a biological mechanism: the emotions. The signal to start a love affair is not given by a resounding rendition of the *Marseillaise* under our new flame's balcony. Neither was Brahms' lullaby played for soldiers charging out of the trenches. Composers of background music for supermarkets or elevators are practising neuropsychology without knowing it.

High-pitched, rapid sounds engender lightness of spirit; high-pitched, slow sounds engender sweetness. Sounds both deep and rapid awaken the fighting spirit; while deep, slow sounds invoke serious emotions, sadness and mourning. These are fundamentally cerebral physico-chemical phenomena, triggered by defined frequencies. We do nothing more than this when we transmit pre-recorded molecular activities to biological systems.

2. Biological systems function like radio sets: by co-resonance. If you tune a receiver to 92.6 MHz, you tune in Radio-This, because the receiver and the transmitter vibrate at the same frequency. If we change the setting a little to, say, 92.7, we no longer receive Radio-This, but Radio-That instead.

We have recently completed very simple experiments showing that a molecule at a normally active concentration does not work in a medium devoid of water.

Adding water is not enough to restore activity: it must be "informed".

3. These advances in understanding the inmost mechanism of molecular recognition and signalling do not overturn the science of biology and, even less, physics and chemistry. We have taken nothing away from classic descriptions, but only taken a step forward by adding to the present body of knowledge. This is the normal course of scientific progress, and there is no reason for it to provoke imprecations and anathema.

We can now understand how millions of biological molecules can communicate (at the speed of light), each with its *own* corresponding molecule and *it alone*, the basic requirement for the functioning of biological systems, and why minute chemical modifications produce considerable functional consequences—something "structural" biologists are at a loss to explain.

In deciding that only structures can have an action, biologists find themselves in a pre-Newtonian world where the movement of celestial bodies is described by Ptolemy in terms of epicycles. Hence the inability of contemporary biology to provide answers to the major pathologies of the end of this century (refer to my article in *Le Monde*, 22 May 1996, which has not been challenged to date).

The passage from the rigid biology of structures to one of information travelling at the speed of light can be accomplished without a "revolution". Contrary to what is stupidly claimed by scientific gossips, recording the activity of molecules no more implies denying their existence (after all, molecule-specific electromagnetic messages must come from specific molecules) than it implies denying the law of mass action, according to which the effect is directly proportional to the number of molecules. One might as well expect a singer to disappear by recording his voice! In other words, we eliminate neither the light switch nor the light bulb; we only say that a wire with a current of electrons connects the two.

We are not in another electromagnetic world which we are substituting for the old molecular world. We capture, copy, transfer—and soon will modify—electromagnetic signals emitted by molecules in the course of their normal functioning.

The Memory of Water

What about water in all this? It is the vehicle for information. This cannot be avoided, since there are 10,000 water molecules in the human body for every molecule of protein. There is no problem with this either: a submarine communicates with its base via low-frequency electromagnetic waves, not with megahertz frequencies which do not penetrate water.

We have recently completed very simple experiments showing that a molecule at a normally active concentration does not work in a medium devoid of water. Adding water is not enough to restore activity: it must be "informed". In other words, when molecules trigger a biological effect, they are not directly transmitting the signal. The final job is done by perimolecular water which relays and possibly

amplifies the signal. Sound is not directly created by a compact disc: the latter carries data which are audible only after being amplified by an electronic system.

The "memory of water"? It is more mysterious, but no more so than the fact that a compound formed from two gases should be liquid at normal temperature and pressure but show dilation as it cools. Coherent domains with laser-like properties have been described in water (E. del Giudice, G. Preparata, G. Vitiello [1988], "Water as a free electric dipole laser", *Phys. Rev. Lett.* 61:1085-1088). More recently, a unique type of stable (non-melting) ice crystal that maintains an electrical field has been identified and characterised in water (Shui-Yin Lo, Angela Lo, Li Wen Chong et al. [1996], "Physical properties of water with IE structures", *Modern Physics Letters B*, 10[19]:921-930). Truly, unemployment should not be a worry for physicists! Nonetheless, water has not been our subject of investigation for a long time.

Transmission of Molecular Signals

What interests us now is not the nature of the magnetic medium and how it functions, but the message recorded in it, which can be copied and transmitted. In the light of our experimental results, we are confident in our belief that we have elucidated the physical nature of the molecular signal. The principle is as simple as exploding a mixture of air and gasoline, but the consequences are enormous. We present them in detail elsewhere. Here is a summary...

At the present time, the only way to identify a molecule is to carry a sample, most often obtained invasively or even destructively, to a laboratory. With the digital method, we dispose of a signal which can be instantly transmitted and analysed at the other end of the world by classic means of telecommunication. Using this method, the detection of toxic substances, proteins (antigens, antibodies, prions) or molecular complexes (parasites, bacteria, viruses, abnormal cells) should become possible.

It is noteworthy that no *in vivo* methods of prion detection presently exist—with well-known epidemiological and economic consequences. The detection of antigens and antibodies, just to mention this field, represents a considerable share of the activity of clinical biology laboratories. Moreover, some results seem to indicate that these methods should be applicable to the chemical industry and to environmental surveillance, e.g., for detecting, at a distance, micro-organisms or products from genetically modified plants.

Completion of these projects would have immense consequences on medical diagnostic procedures and the agro-food industry, with huge technological and commercial impact.

Scientific Mental Blocks

A final question: why are scientists so opposed to the evolution of science? Is it to defend their piece of turf? Why, in the name of intangible dogmas—which the history of science has shown to be so often ephemeral—do they reject advances which represent progress for their discipline? Do these advances appear to threaten their all-too-fragile certitudes? Such questions are not just philosophical, because these people are respected counsellors, advisers to political and industrial decision-makers. They orient—most often by hampering—new applications flowing from scientific progress.

I don't know where these mental blocks come from, but they are, in theory at least, irreconcilable with a scientist's function. Here is a quote (translated from the French edition of *Encyclopaedia Universalis*, taken from the article on "Mechanism") which shows, alas, that those blocks are eternal:

"We have a good example of the dilemma of 'mechanism' in the Cartesians' opposition to the Newtonian world-view, which they felt completely called into question the new science and pushed scientific thinking back to a level beneath what 'mechanism' had already achieved. The problem is, for Descartes, that movement is only possible if there is contact and impulsive force; action at a distance—attraction, as Fontenelle was to say—can only mean a return to a physics of sympathetic motion and occult attributes... In this way, they do not engage Newton in a scientific controversy; they disqualify him for obscurantism. Thus the French scientific community resisted Newtonian theory for a long time, or would prefer to ignore it… But 'mechanism', which is an obstacle to scientific progress, remains blocked. No doubt, Newton is less an opponent of 'mechanism' than he is the proposer, by provoking a total break of another model of physical mechanics in which movements other than those produced by impulsion become possible."

Four centuries later, we hear the same words, "There must be molecules" (François Jacob)—that is, contact, forceful impulsion—according to our sages of science, still frozen in the Cartesian mechanistic dogma; the same denial of action at a distance; and the same accusations of a return to obscurantism.

Descartes versus Newton: we're in good company… ∞

— J. Benveniste
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